

REMARKS

Claims 63-66 are added. Claims 42-66 remain in the application. Reconsideration of the application in view of the amendments and the remarks to follow is requested.

Claims 42-62 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Shan et al. (5,865,937) (hereinafter Shan '937) in view of Shan et al. (5,605,637) (hereinafter Shan '637) and Beisswenger et al. (5,102,523) (hereinafter Beisswenger).

Regarding independent claim 42, such claim recites applying RF power to both a susceptor and a showerhead electrodes from a single RF power generator, the applied power defining a selected power ratio that is a function of a ratio of electrode areas A_1/A_2 and being split between the susceptor and showerhead electrodes. The Examiner correctly states Shan '937 fails to teach a power ratio based on an electrode area ratio (pg. 3 of paper no. 4). Accordingly, the Examiner relies on teachings of Shan '637 and Beisswenger to allegedly supply this deficiency in teachings of Shan '937 (pgs. 3-5 of paper no. 4). However, Shan '637 and Beisswenger fail to teach or suggest the positively recited limitation, and therefore, the obviousness rejection fails. The Examiner is respectfully reminded that the MPEP states that to establish *prima facie* obviousness of a claimed invention, all of the claimed limitations must be taught or suggested by the prior art. MPEP §2143.03 (8th edition) *citing In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability

of that claim against the prior art." MPEP §2143.03 (8th edition) *citing In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). Further, all such elements must be shown to be suggested by the prior art when making a rejection based upon obviousness under 35 U.S.C. §103(a). *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1987).

Regarding Shan '637, such teaches the DC voltages (see col. 4, lines 9-11) that result from application of RF power to electrodes having different surface areas are proportional to the surface areas. Shan '637 does not teach use of any selected power ratio. Shan '637 teaches instead modification of the effective surface area of an electrode, for example cathode 12, through incorporation of a sleeve 38 of insulating material (col. 4, lines 32-46). As a result of modification of the effective surface area ratio, the DC voltage V_{DC} , which is clearly identified in col. 4, line 19 as the DC bias on the cathode 12, is related to the effective surface area. The use of the capital letter "V" conveys immediately that this is a DC voltage, and does not pertain to a power ratio of RF energy or have anything at all to do with an RF power ratio. Further, Shan '637 clearly only states the DC bias value of single electrode 12 increases with increasing RF power and is approximately proportional to some power of the ratio of surface area (col. 4, lines 5-15) and does not teach or suggest splitting RF power between plural electrodes according to the claimed ratio. Claim 42 recites applying RF power to both the susceptor and showerhead electrodes from a single RF power generator, the applied power defining a selected power ratio that is a function of a ratio of electrode areas A_1/A_2 and being split between the susceptor and showerhead electrodes. The DC power ratio teachings

of Shan '637 does not teach, disclose, suggest or motivate a selected RF power ratio as positively recited in claim 42.

Shan '637 further does not teach the applied RF power being split between the susceptor and showerhead electrodes as positively recited in claim 42. The words "split" and "splitter" do not appear anywhere in Shan '637, and no applied RF power being split or any equivalent thereof is shown in the drawings. Further, no equivalent to an applied power being split is mentioned anywhere in Shan '637. To the contrary, Shan '637 clearly states electrode 14 is grounded in column 3, lines 45-65. Shan '637 fails to disclose or suggest splitting RF power between the plural electrodes. Accordingly, Shan '637 fails to teach or suggest any selected RF power ratio or the applied RF power defining a selected power ratio that is a function of a ratio of electrode areas A_1/A_2 as positively recited in claim 42.

Regarding Beisswenger, similar to Shan '637, such reference merely teaches the DC voltages that result in the ABSENCE of any RF applied power being split as positively recited in claim 42. Beginning at col. 3, line 6, Beisswenger teaches that, "[a]s already stated above, in time a dc voltage U_{\pm} sets up between the plasma 7 and the electrode 3 which is generated *due to the greater mobility of the electrons in comparison to the ions*" (emphasis added). The Examiner's attention should be drawn to the use of a capital letter "U" to represent DC potential, and be drawn to the fact that splitting RF power divides RF signals, not DC signals. Accordingly, DC potentials are produced by natural phenomena associated with plasma physics, and are not produced by components, such as RF power splitters, that might be supplied by Beisswenger.

Beisswenger further teaches partial DC voltages U_1 and U_2 , as shown in Fig. 2, and note, that no splitting RF power is shown in Fig. 2. The use of the capital letter "U" conveys immediately that these are DC voltages, and do not pertain to RF energy or have anything at all to do with an RF applied power being split. In fact, Beisswenger teaches deliberately varying the areas of the electrodes in order to alter the DC bias developing thereon, *instead of splitting RF power*. It is also noted that Beisswenger is silent with respect to splitting RF power. Without teachings to applied power being split, it is impossible for Beisswenger to teach or suggest any applied power defining a selected power ratio. Logically, it is also impossible for Beisswenger to teach or suggest the applied power defining a selected power ratio that is a function of a ratio of electrode areas A_1/A_2 as positively recited in claim 42.

Concluding regarding teachings of Beisswenger and Shan '637, both describe a well-known, well understood relationship between electrode areas and DC voltages that develop *when there is no splitting RF power involved*. This is why this relationship is a recurring theme. That is, the relationship given by Beisswenger and Shan '637 describes, in fact, one of the problems challenging Beisswenger and Shan '637 and that problem is solved by the invention recited in Applicant's claims. Shan '637 explicitly points out problems resulting from this phenomenon at col. 4, lines 28-30. Beisswenger describe such problems at col. 2, lines 7-15.

Since each reference singularly, that is, Shan '937, Shan '637 and Beisswenger, fail to teach or suggest the **applied RF power defining a selected power ratio that is a function of a ratio of electrode areas A_1/A_2** as positively

recited in claim 42, it is inconceivable that any combination of the references teaches or suggests the positively recited limitation. Therefore, the art of record fails to teach or suggest, singularly or in any combination, a positively recited limitation of claim 42. Claim 42 is allowable.

Additionally, claim 42 recites providing a susceptor electrode having a first effective area A_1 , and providing a showerhead electrode having a second effective area A_2 that is less than A_1 . Respectfully, the Examiner fails to point to any teachings in the references to such positively recited limitation.

Moreover, the art of record fails to teach or suggest such recited limitation of claim 42. Shan '937 teaches an effective area of an anode (electrode over wafer) is much greater than the area of the cathode/wafer pedestal (col. 1, lines 30-33). Shan '637 teaches that the area of the anode includes the upper electrode 14 (over wafer 22) and sidewall 10 which is greater than that of lower electrode 12 (for receiving wafer 22) (Fig. 1; col. 4, lines 24-30). Beisswenger teaches electrode 2 (over substrate 4) "has a significantly larger surface area than the electrode 3" (for receiving substrate 4) (col. 3, lines 37-41). Consequently, each reference teaches the electrode over the wafer/substrate is larger than the electrode supporting the wafer/substrate. Consequently, it is inconceivable that Shan '937, Shan '637 and Beisswenger, singularly or in any combination, teach or suggest providing a susceptor electrode having a first effective area A_1 , and providing a showerhead electrode having a second effective area A_2 that is less than A_1 , as positively recited in claim 42. Therefore, the art of record fails to teach or suggest, singularly

or in any combination, another positively recited limitation of claim 42. Claim 42 is allowable.

Additionally, an improper motivational rationale is provided for the combination of art, and therefore, the obviousness rejection against claim 42 fails for this reason. The Examiner is respectfully reminded that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. MPEP §2143.01 (8th edition) *citing In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). “Preferably the Examiner’s explanation should be such that it provides that impetus necessary to cause one skilled in the art to combine the teachings of the references to make the proposed modification.” *Ex Parte Levingood*, 28 USPQ2d, 1300, 1301, Footnote 2, (Bd. Pat. App. and Inter. 1993) (citations omitted).

The Examiner’s stated motivation for modifying the invention of Shan ‘937 is stated as, it would be obvious to modify the Shan ‘937 reference by implementing non equal areas of lower and upper electrodes for the benefit of adjusting the voltage as described in Shan ‘637 and Beisswenger (pg. 5 of paper no. 4). Initially, Shan ‘637 grounds the top electrode and Beisswenger discloses both electrodes coupled across the RF source. One would not be motivated to combine the disparate reference teachings which disclose the different configurations for coupling the RF power. Further, the teachings of Beisswenger and Shan ‘637 both

describe a relationship between electrode areas and DC voltages. Regarding Shan '937, an electronic search of Shan '937 verifies "DC" and "voltage" (or "volt") are not recited once in the reference. Accordingly, Shan '937 is not dealing with, nor concerned with, DC voltages. Therefore, one skilled in the art with the understanding of Shan '937, which is not concerned with DC voltages, would not be motivated to look to teachings of Shan '637 and Beisswenger for teachings which are not needed. Consequently, the Examiner's stated motivational rationale for modifying Shan '937, **adjusting the DC voltage**, does not exist. The Examiner's explanation does provide that impetus necessary to cause one skilled in the art to combine the teachings of the references to make the proposed modification to the Shan '937 invention. For this reason, the obviousness rejection based on this non-existing rationale must fail. Claim 42 is allowable.

Claims 43-48 and 63 depend from independent claim 42, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

Regarding the rejection against independent claim 49, such recites providing a susceptor electrode having a first effective area A_1 , and providing a showerhead electrode having a second effective area A_2 ; and a first power component being applied to the susceptor electrode and a second power component being applied to the showerhead electrode, the **second power component being related to a power of A_1/A_2** . The Examiner correctly states Shan '937 does not teach power ratio based on the electrode area ratio (pg. 3 of paper no. 4). Shan '637 and

Beisswenger both describe a relationship between electrode areas and DC voltages, and do not teach or suggest any power relationship based on areas of electrodes. Consequently, the art of record, singularly or in any combination, fails to teach or suggest a second power component being related to a power of A_1/A_2 as positively recited in claim 49. Since the the art of record, singularly or in any combination, fails to teach or suggest a positively recited limitation of claim 49, such claim is allowable.

Moreover, claim 49 recites providing a transformer having an input side and an output side, the output side comprising a plurality of coils, and forming an operative connection between the transformer input side and a single RF power generator, the generator being configured to provide RF power to the transformer input side; and forming an operative connection between the transformer output side and the susceptor and showerhead electrodes. Shan '637 and Beisswenger are devoid of any teaching to transformers or equivalents thereof, and an electronic search verifies "transformer" is not recited in either reference. Shan '937 teaches use of an **autotransformer** having a continuous coil instead of a transformer having an input side and an output side. In the background section, Shan '937 teaches (col. 1, lines 62-65) that, "[a] transformer can couple RF power to the anode and cathode, the RF power source being connected across the primary winding and the anode and cathode being connected to opposite ends of the secondary winding." However, Shan '937 teaches (col. 1, line 66 through col. 2, line 2) that this approach has multiple disadvantages. Accordingly, Shan '937 teaches away from the invention as recited in any of Applicant's claims. Such teaching

away is the antithesis of the art suggesting that the person of ordinary skill would go in the claimed direction. Essentially, teaching away from the art is a *per se* demonstration of lack of obviousness. *In re Dow Chemical Co.*, 837 F.2d 469, 5 USPQ2d 1529 (Fed. Cir. 1988). For this additional reason, claim 49 is allowable.

Additionally, the motivation for the combination of Shan '937, Shan '637 and Beisswenger is stated as, it would be obvious to modify the Shan '937 reference by implementing non equal areas of lower and upper electrodes fo the benefit of adjusting the voltage as described in Shan '637 and Beisswenger (pg. 5 of paper no. 4). Initially, Shan '637 grounds the top electrode and Beisswenger discloses both electrodes coupled across the RF source. One would not be motivated to combine the disparate reference teachings which disclose the different configurations for coupling the RF power. Additionally, the teachings of Beisswenger and Shan '637 both describe a relationship between electrode areas and **DC voltages**. Regarding Shan '937, an electronic search of Shan '937 verifies "DC" and "voltage" (or "volt") are not recited once in the reference. Accordingly, Shan '937 is not dealing with, nor concerned with, DC voltages. Therefore, one skilled in the art with the understanding of Shan '937, which is not concerned with DC voltages, would not be motivated to look to teachings of Shan '637 and Beisswenger for teachings which are not needed. Consequently, the Examiner's stated motivational rationale for modifying Shan '937, adjusting the DC voltage, does not exist. For this additional reason, claim 49 is allowable. Additionally, all the claims are rejected under this improper motivational rationale, and therefore, claims 50-66 are allowable.

Claims 50-53 and 64 depend from independent claim 49, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

Regarding the rejection against independent claim 54, such recites splitting RF power produced by a single RF power source into first P_1 and second P_2 RF power components of different magnitudes, and powering only two processing chamber electrodes having respective effective areas A_1 and A_2 with the respective different magnitude first and second RF power components, respectively, wherein one of the power components P_1 and P_2 is a function of a ratio A_1/A_2 between the respective effective areas. The Examiner correctly states Shan '937 fails to teach a power ratio based on an electrode area ratio (pg. 3 of paper no. 4). Additionally, Beisswenger and Shan '637 both describe a relationship of electrode areas and DC voltages that develop *when there is no splitting RF power involved*. Therefore, it is inconceivable that Beisswenger and Shan '637 could teach or suggest one of the power components P_1 and P_2 is a function of a ratio A_1/A_2 between the respective effective areas in combination with splitting RF power as positively recited by claim 54. Since each reference singularly fails to teach or suggest a positively recited limitation of claim 54, it is inconceivable that any combination of the references teaches or suggests the positively recited limitation. Claim 54 is allowable.

Claims 55-58 and 65 depend from independent claim 54, and therefore, are allowable for the reasons discussed above with respect to the independent claim,

as well as for their own recited features which are not shown or taught by the art of record.

Regarding the rejection against independent claim 59, such recites splitting RF power between only a susceptor electrode and a showerhead electrode, wherein the showerhead electrode has a surface area A_2 smaller than a surface area A_1 of the susceptor electrode, wherein a power component P supplied to the showerhead component is a function of a ratio A_1/A_2 of the areas. The Examiner correctly states Shan '937 fails to teach a power ratio based on an electrode area ratio (pg. 3 of paper no. 4), and therefore, it is inconceivable that such reference could teach or suggest a power component P supplied to the showerhead component is a function of a ratio A_1/A_2 of the areas. Additionally, Beisswenger and Shan '637 both describe a relationship between electrode areas and DC voltages that develop *when there is no splitting of RF power involved*. Therefore, it is inconceivable that Beisswenger and Shan '637 could teach or suggest a power component P supplied to the showerhead component is a function of a ratio A_1/A_2 of the areas in combination with splitting of RF power as positively recited by claim 59. Since each reference singularly fails to teach or suggest a positively recited limitation of claim 59, it is inconceivable that any combination of the references teaches or suggests the positively recited limitation. Claim 59 is allowable.

Moreover, the art of record fails to teach or suggest the showerhead electrode has a surface area A_2 **smaller than** a surface area A_1 of the susceptor electrode as positively recited in claim 59. Shan '937 teaches an effective area of an anode (electrode over wafer) is much greater than the area of the cathode/wafer

pedestal (col. 1, lines 30-33). Shan '637 teaches that the area of the anode includes the upper electrode 14 (over wafer 22) and sidewall 10 which is greater than that of lower electrode 12 (for receiving wafer 22) (Fig. 1; col. 4, lines 24-30). Beisswenger teaches electrode 2 (over substrate 4) "has a significantly larger surface area than the electrode 3" (for receiving substrate 4) (col. 3, lines 37-41). Consequently, each reference teaches the electrode over the wafer/substrate is larger than the electrode supporting the wafer/substrate, and therefore, it is inconceivable any combination of the art teaches or suggests the showerhead electrode has a surface area A_2 **smaller than** a surface area A_1 of the susceptor electrode as positively recited in claim 59. Therefore, the art of record fails to teach or suggest, singularly or in any combination, another positively recited limitation of claim 59. Claim 59 is allowable.

Claims 60-62 and 66 depend from independent claim 59, and therefore, are allowable for the reasons discussed above with respect to the independent claim, as well as for their own recited features which are not shown or taught by the art of record.

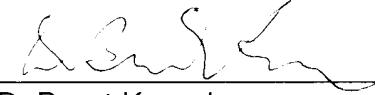
Further, Applicant herewith submits a duplicate copy of the Information Disclosure Statement and Form PTO-1449 filed together with this application on January 14, 2002. No initialed copy of the PTO-1449 has been received back from the Examiner. To the extent that the submitted references listed on the Form PTO-1449 have not already been considered, and the Form PTO-1449 has not been initialed with a copy being returned to Applicant, such examination and

initialing is requested at this time, as well as return of a copy of the initialed Form PTO-1449 to the undersigned.

This application is now believed to be in immediate condition for allowance, and action to that end is respectfully requested. If the Examiner's next anticipated action is to be anything other than a Notice of Allowance, the undersigned respectfully requests a telephone interview prior to issuance of any such subsequent action.

Respectfully submitted,

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By: 
D. Brent Kenady
Reg. No. 40,045